US009481008B2

(12) **United States Patent**
Zolli et al.

(10) **Patent No.: US 9,481,008 B2**
(45) **Date of Patent: Nov. 1, 2016**

(54) **RECLAIM SEALER APPLICATION APPARATUS AND METHOD**

(71) Applicant: **Toyota Motor Engineering & Manufacturing North America, Inc.**, Erlanger, KY (US)

(72) Inventors: **Frank Zolli**, Brantford (CA); **Matt Neal Jantzi**, Baden (CA); **Michael Haller**, Kitchener (CA); **Grant Daniel Balfoort**, Brantford (CA)

(73) Assignee: **Toyota Motor Engineering & Manufacturing North America, Inc.**, Erlanger, KY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 176 days.

(21) Appl. No.: **13/939,898**

(22) Filed: **Jul. 11, 2013**

(65) **Prior Publication Data**

US 2015/0017332 A1 Jan. 15, 2015

(51) **Int. Cl.**

B05C 11/10	(2006.01)
B05C 5/02	(2006.01)
B05C 9/12	(2006.01)

(52) **U.S. Cl.**

CPC ***B05C 11/1039*** (2013.01); ***B05C 5/0216*** (2013.01); *B05C 9/12* (2013.01); *Y10T 137/85954* (2015.04)

(58) **Field of Classification Search**

CPC B05C 11/1039; B05C 9/12
USPC 427/345
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,450,092	A	6/1969	Kock	
4,607,592	A	8/1986	Richter	
6,037,009	A *	3/2000	Clare et al.	427/207.1
6,391,271	B1 *	5/2002	Debailleul	A62D 3/36 423/167.1
2004/0060510	A1	4/2004	Ciarelli et al.	
2010/0206341	A1 *	8/2010	Essenburg et al.	134/45
2012/0308732	A1 *	12/2012	Chiang et al.	427/421.1

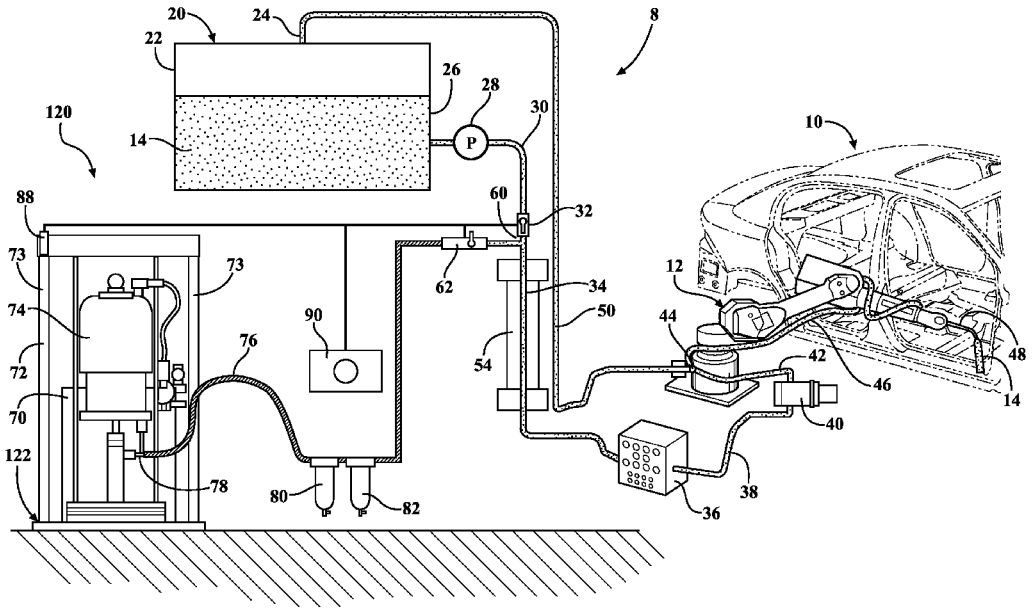
* cited by examiner

Primary Examiner — Alexander Weddle
(74) *Attorney, Agent, or Firm* — Christopher G. Darrow; Darrow Mustafa PC

(57) **ABSTRACT**

An apparatus and method for supplying virgin sealer and reclaim sealer to a sealer applicator. A closed loop path including a first fluid flow path is coupled between a source of virgin sealer and the applicator and includes a recirculation path from the applicator back to the source of virgin material. A reclaim sealer supply is coupled to the first fluid flow path. Valves open and close the virgin sealer supply and the reclaim sealer supply to alternately supply virgin sealer or reclaim sealer to the applicator. Whenever the first fluid flow path contains reclaim sealer, a valve blocks flow to the recirculation path to prevent reclaim sealer from being recirculated into the source of virgin sealer.

9 Claims, 4 Drawing Sheets



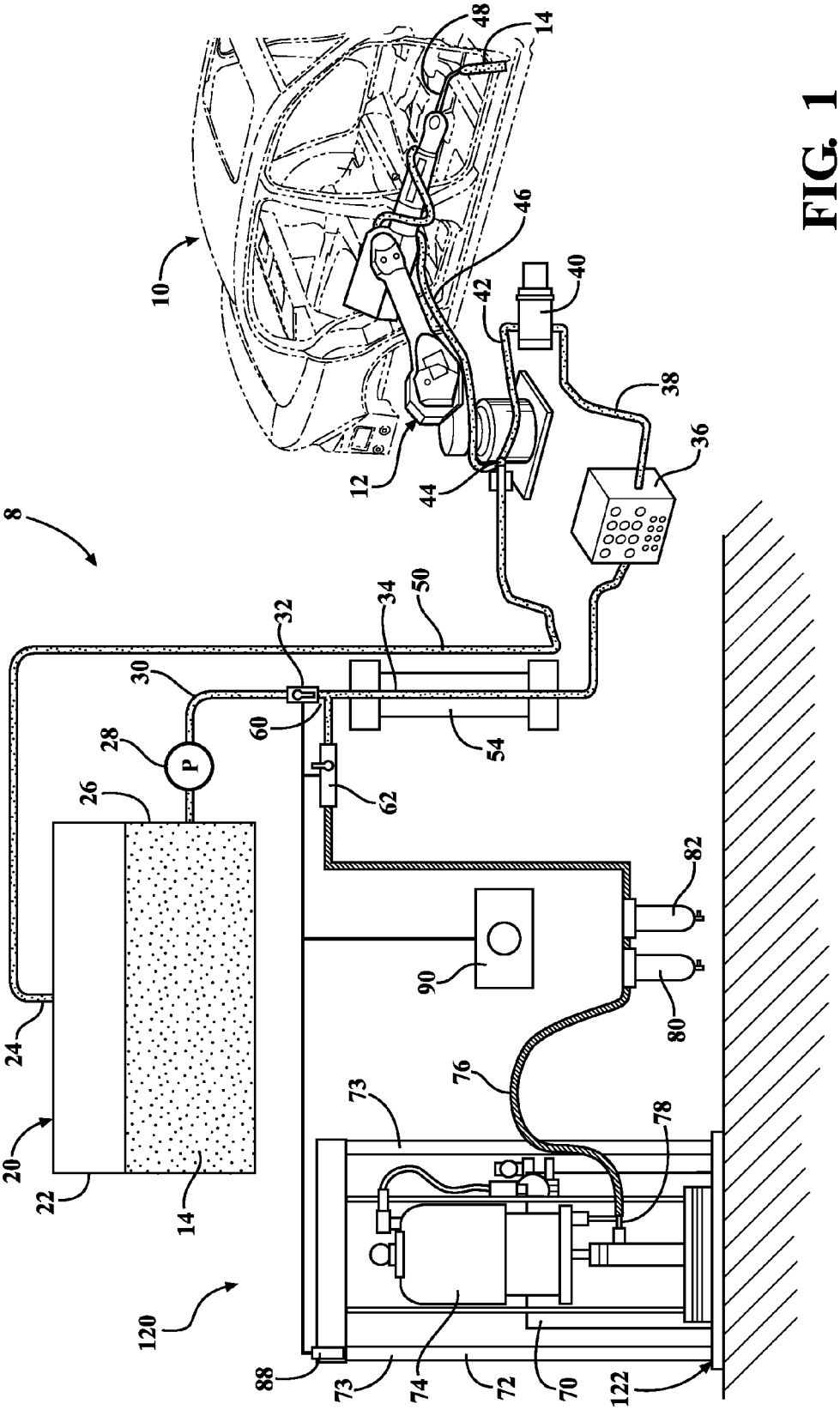

48
14
46
10
42
40
38
36
12
44
8
34
50
32
30
60
28
P
54
62
26
82
90
80
24
76
73
78
20
22
14
120
88
73
74
72
70
122

FIG. 1

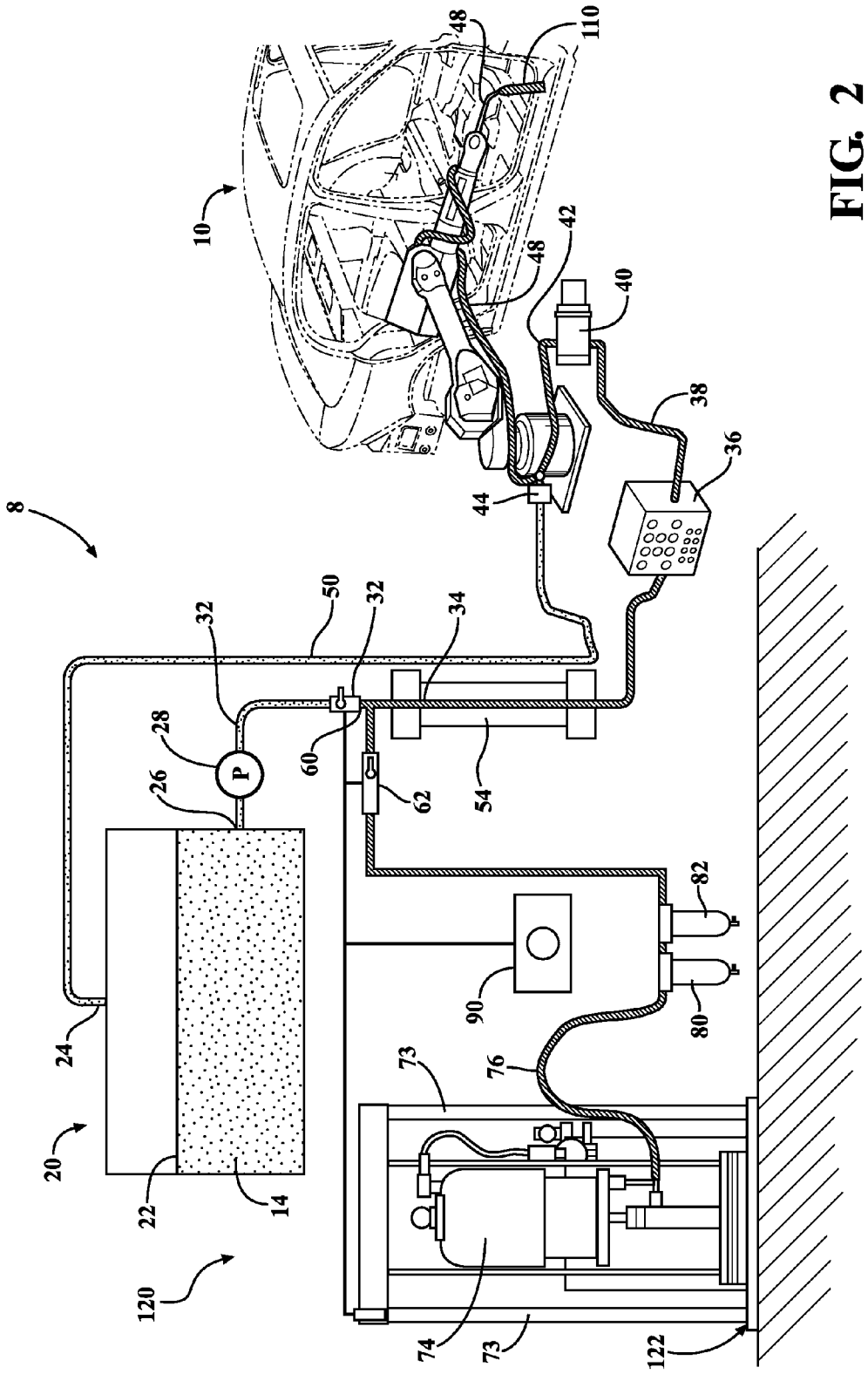

8
10
110
48
42
40
38
36
44
50
32
34
28
P
26
60
62
54
82
90
80
24
73
76
20
22
14
120
74
73
122

FIG. 2

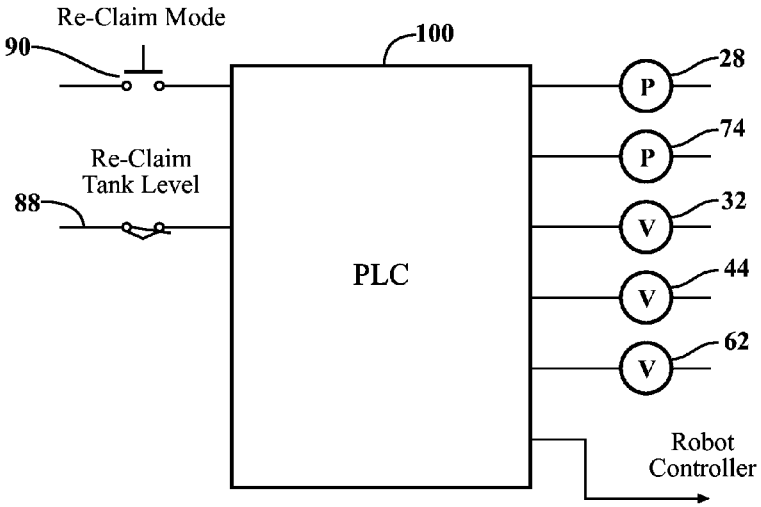

Re-Claim Mode
90
100
28
P
74
P
Re-Claim
Tank Level
88
32
V
PLC
44
V
62
V
Robot
Controller

FIG. 3

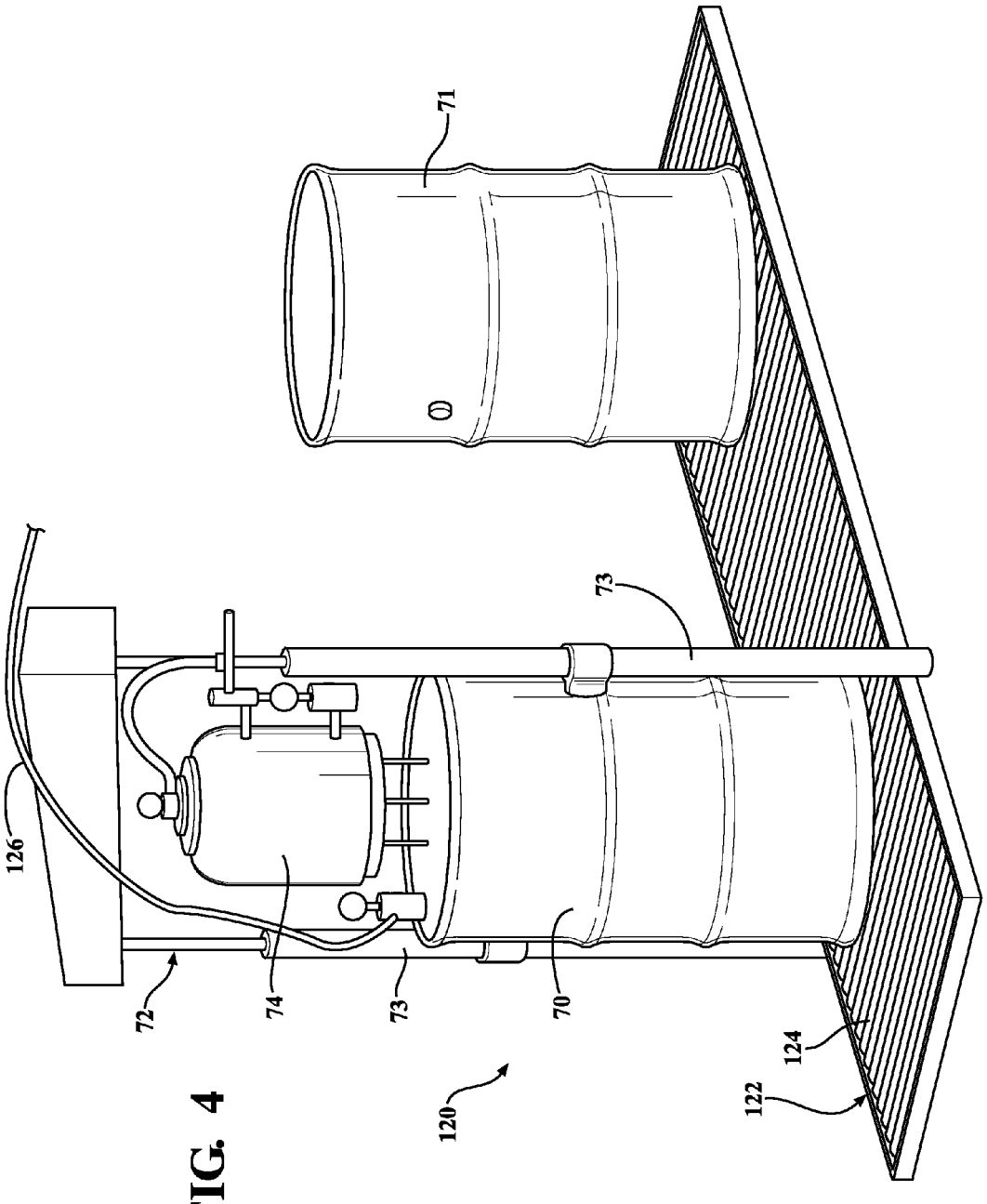


FIG. 4

RECLAIM SEALER APPLICATION APPARATUS AND METHOD

BACKGROUND

This specification relates, in general, to vehicle sealer application systems.

Flowable sealer material is applied to various locations in a vehicle body during vehicle assembly such as to panel and to seal gaps between welded or fastened panels. The sealer is a flowable material applied by robot applicators or by operator manipulated applicators.

Excess applied sealer is removed for quality purposes by manual scraping. The excess sealer is stored in barrels and then disposed of following toxic material disposal procedures.

The excess sealer constitutes a hazardous waste and thereby poses hazardous waste generation and disposal issues. In addition, the cost of the excess waste sealer is lost money affecting the overall cost of manufacturing the vehicle.

There is a need to provide a method for recycling the excess sealer which reduces hazardous waste generation and provides a significant sealer material cost savings.

SUMMARY

An apparatus for supplying virgin sealing material and reclaim sealing material through a supply path to an applicator is disclosed.

The apparatus for applying sealing material through an applicator to a surface includes a source of virgin applied material sealer, a closed loop fluid flow pathway for supplying virgin material to the applicator and an excess recirculation path from the applicator to the source of virgin sealer. A first valve is positioned in the closed loop pathway to block the virgin sealer flow through a first portion of the closed loop pathway. A second valve is coupled in the closed loop pathway to control the flow of sealer through the recirculation path back to the source of virgin sealer. A source of reclaim sealer is coupled to a multi input node or the connection disposed in fluid flow communication with the closed loop pathway. A third valve is disposed in the supply path between the source of reclaim sealer and the node for controlling the flow of reclaim sealer to the node. A control controls the first valve, the second valve, and the third valve to selectively supply virgin sealer and reclaim sealer to the applicator while blocking recirculation of the reclaim sealer through the recirculation path to the source of virgin sealer.

The control operates to open the first valve, to open the second valve and to close the third valve to supply virgin sealer from the source of virgin sealer through the closed loop pathway, through the node to the applicator and then through the second valve and the recirculation path back to the source of virgin sealer.

The control operates to close the first valve, close the second valve and open the third valve to supply reclaim sealer from the source of reclaim sealer through the node and a first flow path portion of the close loop pathway to the applicator.

The control operates, after closing the third valve and opening the first valve, to maintain the second valve closed until all of the reclaim sealer in the first fluid flow path of the closed loop path is discharged through the applicator.

A method of supplying virgin sealer and reclaim sealer to a vehicle body includes providing a virgin sealer fluid flow loop to an applicator including a first fluid flow path from a source of virgin material to the applicator and a recirculation path of virgin sealer from the applicator back to the source of virgin sealer, supplying reclaim sealer from a source of reclaim sealer through a portion of the first fluid flow path to the applicator, while blocking the recirculation flow path from recirculating reclaim sealer.

The method includes coupling a first valve between the source of virgin sealer in the first fluid flow loop, coupling a second valve in fluid flow communication between the applicator, the first fluid flow loop and the recirculation path, coupling a third valve in fluid flow communication between the source of reclaim sealer and the first fluid flow loop.

The method includes controlling the opening and closing of the first valve, the second valve, and the third valve by opening the first valve and the second valve to allow flow of virgin sealer for the source of virgin sealer in the first fluid flow path to the applicator and back through the recirculation path to the source or virgin sealer while blocking flow or reclaim sealer through the portion of the first fluid flow loop.

The control also controls the opening and closing of the first valve, the second valve, and the third valve to allow flow of reclaim sealer to a portion of the first fluid flow loop to the applicator while blocking flow of reclaim sealer through the recirculation path.

The control closing the third valve to block flow of reclaim sealer into the first fluid flow loop, opening the first valve to allow flow of virgin sealer through the first fluid flow loop, and maintaining the third valve in a closed position blocking flow through the recirculation path until the first fluid flow path is clear of reclaim sealer.

The supply of virgin sealer when flowing through the first fluid flow loop forces the reclaim sealer through the first fluid flow loop to the applicator.

The method also couples at least one filter in a reclaim sealer supply path between the source of reclaim sealer and the connection to the first fluid flow path.

The method includes applying virgin sealer and reclaim sealer applied to a vehicle body by a robotic controlled applicator.

BRIEF DESCRIPTION OF THE DRAWING

The various features, advantages, and other uses of the present reclaim sealer application apparatus and method will become more apparent by referring to the following detailed description and drawing in which:

FIG. **1** is a pictorial representation of a vehicle sealer application system employing a reclaim sealer system and showing the virgin sealer and reclaim sealer systems in a virgin sealer application mode,

FIG. **2** is a pictorial representation, similar to FIG. **1**, but showing the virgin sealer and reclaim sealer systems in a reclaim sealer application mode,

FIG. **3** is a schematic diagram of controller for controlling the sealer application apparatus shown in FIGS. **1** and **2**, and

FIG. **4** is a perspective view of a reclaim sealer barrel change-out apparatus.

DETAILED DESCRIPTION

Referring now to to the drawing, and to FIGS. **1-3** in particular, there is depicted a vehicle virgin and reclaim sealer application apparatus **8** and method.

Flowable sealer material is applied to various locations in a vehicle body **10** during vehicle assembly by a manual

applicator, not shown, and/or by a robotic controller applicator **12**. FIGS. **1** and **2** depict a robotic sealer applicator **12**, hereafter "applicator **12**," located on one side of the vehicle body **10**. It will be understood, that a vehicle assembly operation can have a pair of robotic sealer applicators **12** located on opposite sides of the vehicle body **10** for applying sealer material to the similar locations on opposite sides of the vehicle body, such as rocker seams, floor seams, door seams, etc.

By way of example only, the sealer application apparatus **8** includes a source **20** of virgin sealer **14**. The virgin sealer source **20** will typically include a refillable tank **22** having an inlet **24** and an outlet **26**. A pump **28** is coupled in fluid communication with fluid flow lines or conduits coupled to the tank outlet **26** for discharging virgin sealer **14** from the tank **22** to the applicator **12**.

The virgin sealer applicator apparatus **8** includes a closed loop flow path formed of conduits or pipe extending from the outlet **26** of the tank **22** through the pump **28**, a first supply line **30**, a first controllable valve **32** for opening and closing fluid flow from the first supply line **30** to a second supply line **34**, a node or tee connector **60** in the first supply line **30**, a mastic regulator **36**, a third supply line **38** extending from the mastic regulator **36** to a pump **40**, which may be a gear pump, a fourth supply line **42** extending from the pump **40** to a two position controllable second valve **44** and finally to a fifth supply line **46** extending from the second valve **44** to an actuator **48** on the robot applicator **12**. The closed loop flow path also includes a sixth supply line **50** hereafter referred to as a recirculation line extending in fluid flow communication between the second valve **44** and the inlet **24** of the tank **22**.

The closed loop pathway includes a first fluid flow path including the tee connection **60**, the second supply line **34**, the third supply line **38**, the fourth supply line **42** and the fifth supply line **46**, defined between the first valve **32**, the second valve **44** and the third valve **62**.

In operation, with the first and second valves **32** and **44** disposed in an open fluid flow position, virgin sealer **14** is discharged from the tank **22** by the pump **28** through the first and second supply lines **30** and **34**, the mastic regulator **36**, the third supply line **38**, the pump **40**, the fourth supply line **42**, through the second valve **44** and the fifth supply line **46** to the applicator **48**. Excess sealer is recirculated through the second valve **44** and the sixth supply line **50** back to the tank or source of virgin sealer material **22**. Also shown in FIG. **1**, a heat exchanger **54** is disposed in heat transfer relationship with the second supply line **34** for controlling the temperature of the sealer flowing through the closed pathway loop.

The stippled symbols in the closed loop pathway depict virgin sealer flowing through the closed loop path in a first mode of sealer application to the vehicle body **10**.

A reclaim sealer supply loop is coupled in fluid flow communication with the first fluid flow via a node or tee connection **60** between short length supply lines disposed in fluid flow communication with the first valve **32** and a third valve **62**.

The reclaim sealer apparatus includes a barrel or container **70** containing reclaim sealer which is mountable in a stand **72**, described in greater detail with reference to FIG. **4**, a pump **74** and a supply line or conduit **76** extending from an outlet **78** through first and second replaceable filters **80** and **82** to the third valve **62**.

The reclaim sealer apparatus also includes a level switch, such as proximity switch **88**, mounted on the stand **72** for detecting the level of reclaim sealer in the barrel **70**. A push button or other input actuator **90** is also provided in the reclaim sealer supply loop for initiating the flow of reclaim sealer from the the reclaim sealer barrel **70** to the robotic controlled actuator **48** as described hereafter.

As shown in FIG. **3**, control **100**, such as a programmable logic controller (PLC), is provided for controlling the virgin sealer supply loop and the reclaim sealer supply loop and interfaces with a robot controller for the robot **12**. Inputs to the control **100** include the reclaim tank level switch **88** and the reclaim mode actuator push button **90**.

Outputs controlled by the controller **100** include the first virgin sealer pump **28**, the second reclaim sealer pump **74**, the first valve **32**, the second valve **44** and the third valve **62**.

Operation of the sealer apparatus **8** and method will start with application of virgin sealer to the vehicle body **10**. As shown in FIG. **1**, the pump **28** is actuated by the control **100** to discharge virgin sealer **14** from the tank **22**. The control **100** opens the first valve **32** and the second valve **44** to allow the pump **28** to force virgin sealer **14** through the first and second supply lines **30** and **32**, through the mastic regulator **36**, the third supply line **38** and to the gear pump **40**. The pump **40** pumps the virgin sealer through the fourth supply line **42**, the fifth supply line **46** to the robot controlled applicator **48** where the virgin sealer **14** is applied to selected locations on the vehicle body **10**. Any excess virgin sealer **14** in the closed loop pathway is recirculated in the recirculation supply line **50** through the second valve **44** back to the tank **22**. As noted above, the stippling in FIG. **1** shows the virgin **14** sealer in the closed loop supply **10**.

When it is desired to use the reclaim sealer in the barrel **70**, an operator depresses the push button **90** which, as an input to the control **100**, causes the control **100**, when executing a stored control program, to open the third valve **62** and close the first valve **32** and the second valve **44**. Closure of the second valve **44** closes the recirculation supply line **50** thereby blocking reclaim sealer from flowing through the second valve **44** and the recirculation supply line **50** back to the virgin sealer tank **22**. When the reclaim sealer pump **74** is activated by the control **100**, the pump **74** causes reclaim sealer to flow from the barrel **70** through the supply line **76**, through the filters **80** and **82** which may have different mesh filter sizes, such as **60** mesh for the first filter **40** in line and a smaller **60** mesh in the second filter **82**. The cross hatching shown in FIG. **2** depicts the reclaim sealer flowing through the supply line **76**, the third valve **62**, through the connection **60** into a portion of the first fluid flow path including the second supply line **34**, the mastic regulator **36**, the third supply line **38**, the pump **40**, the fourth supply line **42** and the fifth supply line **46** to the applicator **48** which discharges reclaim sealer denoted by reference number **110** onto selected locations on the vehicle body **10**. Since the second valve **44** is closed to fluid flow, the reclaim sealer cannot enter the recirculation supply line **50** and is thereby prevented from contaminating the virgin sealer source tank **22**. It will be noted that there will be a transition period whereby the sealer application apparatus changes over from virgin sealer to reclaim sealer and back to virgin sealer. At the start of the transition period, as shown in FIG. **1**, the controller **100** closes the first valve **32**, and the second valve **44**, while opening the third valve **62**. However, the tee connection **60**, the first supply line **34**, the second supply line **38**, the pump **40**, the third supply line **42**, the fourth supply line **46**, the fifth supply line **46** as well as the applicator **48** will be filled with virgin sealer. The flow of reclaim sealer through the supply line **76** to the tee connection **60** will then force the remaining virgin sealer in the first fluid flow path out through the applicator **48** onto vehicle body **10** until all of the virgin sealer has been discharged from the first fluid

flow path and only reclaim sealer **48** remains in the first supply line **34**, the second supply line **38**, the third supply line **42**, the fourth supply line **46**, the fifth supply line **46**, and the applicator **48** as shown in FIG. **2**.

A similar transition occurs when the level switch **88** detects that the level of reclaim sealer **70** has reached a low level. At this time, the control **100** closes the third valve **62** and opens the first and second valves **32** and **44**. However, the first, second, third, fourth and fifth supply lines **30**, **34**, **38**, **42**, and **46** as well as the applicator **48** still contain reclaim sealer, as shown in FIG. **2**. Subsequently, the virgin sealer flowing through the first valve **32** and tee connection **60** will force the reclaim sealer remaining in the supply lines out on onto the vehicle body until all of the reclaim sealer shown in FIG. **2** has been discharged from the first fluid flow path leaving only virgin sealer in the supply lines as shown in FIG. **1**.

Referring now to FIG. **4**, there is depicted a changeover apparatus **120** for simplifying the changeover of the barrel **70** of reclaim sealer when the one barrel **70** is exhausted of reclaim sealer with a new barrel **71** filled with reclaim sealer.

As shown in FIG. **4**, the stand **72** includes a pair of vertically extending legs **73** mounted on opposite sides of a frame **122**. The frame **122** includes a plurality of parallel rollers **124** which simplify the movement and exchange of an empty barrel **70** of reclaim sealer with a new full barrel **71** of reclaim sealer. During the barrel changeover, the fluid connections from the pump **74**, the air pressure line **126**, etc., are disconnected from the barrel **70** and the barrel **70** is slid along the rollers **124** out of the stand **72**. The new barrel **71** is then rolled into the stand **72** and connected to the pump **74** and the regulated airline **126** as well as other fluid connections necessary to pump reclaim sealer from the barrel **71** to the discharge line **76**.

What is claimed is:

1. An apparatus for alternatingly supplying sealing material from two sources to an applicator, the apparatus comprising:

an applicator;

a supply line coupled to the applicator;

a source of virgin sealer having an inlet and an outlet;

a source of reclaim sealer;

a first fluid flow path in fluid communication with each of: (1) the source of virgin sealer, (2) the source of reclaim sealer, and (3) the supply line coupled to the applicator, the first fluid flow path configured to alternatingly:

supply virgin sealer from the outlet of the source of virgin sealer to the supply line coupled to the applicator, and

supply reclaim sealer from the source of reclaim sealer to the supply line coupled to the applicator;

a recirculation fluid flow path for recirculating excess virgin sealer, the recirculation fluid flow path extending from an end portion of the first fluid flow path to the inlet of the source of virgin sealer; and

a two position controllable valve positioned between the end portion of the first fluid flow path and the recirculation fluid flow path, the valve configured for: (1) selectively directing the excess virgin sealer through the recirculation fluid flow path, without passing through the supply line coupled to the applicator, when virgin sealer is flowing through the first fluid flow path; and (2) selectively blocking the recirculation fluid flow path when reclaim sealer is flowing through the first fluid flow path, thereby blocking any recirculation of reclaim sealer to the source of virgin sealer.

2. An apparatus for selectively supplying virgin sealing material and reclaim sealing material to an applicator, the apparatus comprising:

a source of virgin sealer having an inlet and an outlet;

a first fluid flow path for supplying virgin sealer from the source of virgin sealer to a supply line coupled to the applicator;

a recirculation path for directing excess virgin sealer from an end portion of the first fluid flow path back to the source of virgin sealer without passing through the supply line coupled to the applicator;

a first valve positioned in the first fluid flow path to control a flow of virgin sealer through a first portion of the first fluid flow path;

a second valve positioned in the first fluid flow path to control a flow of excess virgin sealer through the recirculation path to the source of virgin sealer;

a source of reclaim sealer;

a supply path from the source of reclaim sealer to a node disposed in fluid flow communication with the first fluid flow path;

a third valve positioned in the first fluid flow path between the source of reclaim sealer and the node to control a flow of reclaim sealer through the node;

a control executing a control program to operate the first valve, second valve, and the third valve to selectively supply virgin sealer and reclaim sealer to the applicator without recirculation of the reclaim sealer through the recirculation path to the source of virgin sealer wherein execution of the control program selectively blocks recirculation of the reclaim sealer to the source of virgin sealer.

3. The apparatus of claim **2** wherein:

the control operates to open the first valve, to open the second valve, and to close the third valve to direct a flow of virgin sealer from the source of virgin sealer through the first fluid flow path and the node to the applicator, and then direct excess virgin sealer through the second valve and the recirculation path to the source of virgin sealer.

4. The apparatus of claim **2** wherein:

the control operates to close the first valve, to close the second valve, and to open the third valve to direct a flow of reclaim sealer from the source of reclaim sealer through the node and the first fluid flow path to the applicator.

5. The apparatus of claim **4** wherein:

the control, closing the third valve and opening the first valve, is configured to maintain the second valve in a closed position until all of the reclaim sealer in the first fluid flow path is discharged through the applicator.

6. The apparatus of claim **1** further comprising a reclaim sealer changeover apparatus, the changeover apparatus comprising:

a first container for storing reclaim sealer;

a second container for storing reclaim sealer; and

a support frame for supporting the first container and the second container.

7. The apparatus of claim **6** wherein the support frame comprises a plurality of parallel rollers configured to allow the first and second containers to slide along a length of the support frame.

8. The apparatus of claim **1** further comprising a control configured to operate a plurality of valves to selectively:

supply virgin sealer to the applicator and recirculate excess virgin sealer through the recirculation fluid flow path back to the source of virgin sealer; and

supply reclaim sealer to the applicator without recirculation of the reclaim sealer through the recirculation fluid flow path.

9. The apparatus of claim **1** further comprising:

a supply path from the source of reclaim sealer to a node disposed in fluid flow communication with the first fluid flow path.

* * * * *